

**In the claims:**

Please amend claims 6, 8, 13 and 17 as indicated below:

Please add new claims 21-23 as indicated below.

1. (Original): A magnetoresistance sensor structure comprising:  
a magnetoresistance sensor having a sensor surface plane and comprising a free layer;  
an upper antiferromagnetic layer overlying at least a portion of the free layer; and  
an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer.

2. (Original): The magnetoresistance sensor structure of claim 1, wherein the upper antiferromagnetic layer is PtMn and the upper ferromagnetic layer is CoFe.

3. (Original): The magnetoresistance sensor structure of claim 1, wherein the magnetoresistance sensor is a giant magnetoresistance sensor.

4. (Original): The magnetoresistance sensor structure of claim 1, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie a first portion of the free layer that is less than all of the free layer, and further including  
a cap layer overlying a second portion of the free layer.

5.(Original): The magnetoresistance sensor structure of claim 1, wherein the magnetoresistance sensor is a tunnel magnetoresistance sensor.

6.(Currently amended): ~~The magnetoresistance sensor structure of claim 1, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie substantially all the free layer, and further including~~ A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane and comprising a free layer;

an upper antiferromagnetic layer overlying substantially all the free layer;

an upper ferromagnetic layer overlying substantially all the free layer and contacting the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane,

so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer; and

a cap layer overlying the upper ferromagnetic layer.

7.(Original): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane and comprising:

a lower antiferromagnetic layer, and

a free layer overlying the lower antiferromagnetic layer;

an upper antiferromagnetic layer overlying at least a portion of the free layer; and

an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer.

8.(Currently amended): The magnetoresistance sensor structure of claim 7, wherein the lower antiferromagnetic layer and the upper ~~ferromagnetic~~ antiferromagnetic layer are made of the same material.

9.(Original): The magnetoresistance sensor structure of claim 7, wherein the lower antiferromagnetic layer and the upper antiferromagnetic layer are both PtMn.

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10.(Original): The magnetoresistance sensor structure of claim 7, wherein the upper ferromagnetic layer is CoFe.

11.(Original): The magnetoresistance sensor structure of claim 7, wherein the magnetoresistance sensor is a giant magnetoresistance sensor.

12.(Original): The magnetoresistance sensor structure of claim 7, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie a first portion of the free layer that is less than all of the free layer.

13.(Currently amended): ~~The magnetoresistance sensor structure of claim 7, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie a first portion of the free layer that is less than all of the free layer, and further including~~ A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane and comprising:

a lower antiferromagnetic layer, and

a free layer overlying the lower antiferromagnetic layer;

an upper antiferromagnetic layer overlying a first portion of the free layer that is

less than all of the free layer;

an upper ferromagnetic layer overlying a first portion of the free layer that is less

than all of the free layer and contacting the upper antiferromagnetic layer on a

contact face lying parallel to the sensor surface plane, so that the upper

antiferromagnetic layer lies between the upper ferromagnetic layer and the free

layer; and

a cap layer overlying a second portion of the free layer.

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14.(Original): The magnetoresistance sensor structure of claim 7, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie a first portion of the free layer that is less than all of the free layer, and further including

a lead layer overlying the upper ferromagnetic layer.

15.(Original): The magnetoresistance sensor structure of claim 7, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie a first portion of the free layer that is less than all of the free layer, and further including

a lead layer overlying the upper ferromagnetic layer; and

a cap layer overlying a second portion of the free layer.

16.(Original): The magnetoresistance sensor structure of claim 7, wherein the magnetoresistance sensor is a tunnel magnetoresistance sensor.

17.(Currently amended): ~~The magnetoresistance sensor structure of claim 7, wherein the upper antiferromagnetic layer and the upper ferromagnetic layer overlie substantially all the free layer, and further including~~ A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane and comprising:

a lower antiferromagnetic layer, and

a free layer overlying the lower antiferromagnetic layer;

an upper antiferromagnetic layer overlying substantially all the free layer;

an upper ferromagnetic layer overlying substantially all the free layer and

contacting the upper antiferromagnetic layer on a contact face lying parallel to

the sensor surface plane, so that the upper antiferromagnetic layer lies between

the upper ferromagnetic layer and the free layer; and

a cap layer overlying the upper ferromagnetic layer.

18.(Original): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane, a transverse direction lying in the sensor surface plane, and a longitudinal direction lying perpendicular to the transverse direction and in the sensor surface plane, the magnetoresistance sensor comprising:

a transverse biasing stack including a lower antiferromagnetic layer, and

a free layer overlying the transverse biasing stack; and

a longitudinal biasing stack overlying the magnetoresistance sensor, the

longitudinal biasing stack comprising:

an upper antiferromagnetic layer, and

an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the magnetoresistance sensor.

19.(Original): The magnetoresistance sensor structure of claim 18, wherein the magnetoresistance sensor is a giant magnetoresistance sensor.

20.(Original): The magnetoresistance sensor structure of claim 18, wherein the magnetoresistance sensor is a tunnel magnetoresistance sensor.

21.(New): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane and comprising:

a free layer;

an upper antiferromagnetic layer overlying at least a portion of the free layer in a plane parallel to the sensor surface plane; and

an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer in a plane parallel to the sensor surface plane.

22.(New): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane and comprising:

a lower antiferromagnetic layer;

a free layer overlying the lower antiferromagnetic layer;

an upper antiferromagnetic layer overlying at least a portion of the free layer in a plane parallel to the sensor surface plane; and

an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the free layer in a plane parallel to the surface plane.

23.(New): A magnetoresistance sensor structure comprising:

a magnetoresistance sensor having a sensor surface plane, a transverse direction lying in the sensor surface plane, and a longitudinal direction lying perpendicular to the transverse direction and in the sensor surface plane, the magnetoresistance sensor comprising:

a transverse biasing stack including a lower antiferromagnetic layer;

a free layer overlying the transverse biasing stack; and

a longitudinal biasing stack overlying the magnetoresistance sensor, the

longitudinal biasing stack comprising:

an upper antiferromagnetic layer; and

an upper ferromagnetic layer overlying and contacting at least a portion of the upper antiferromagnetic layer on a contact face lying parallel to the sensor surface plane, so that the upper antiferromagnetic layer lies between the upper ferromagnetic layer and the magnetoresistance sensor in a plane parallel to the sensor surface plane.